

Please amend Page 11, line 1 through Page 12, line 11 as follows:

First lumen 30 and first opening 34 are dimensioned to allow cardioplegic fluid to be delivered at sufficient rates to induce cardioplegic arrest effectively and rapidly. Usually, first lumen 30 will be configured for delivery of a cardioplegic fluid containing blood, which has been shown to more effectively protect the myocardium while the heart is arrested. In such cases, it is important that first lumen 30 allow the cardioplegic fluid to be delivered at sufficient rates to rapidly flow from the aortic root into the coronaries, perfuse the myocardium, and arrest the heart, without requiring the fluid to be delivered at excessive pressures which could damage the blood cells contained in the fluid. Preferably, first lumen 30 will permit delivery of cardioplegic fluid at rates of at least about 150 ml/min and at pressures no more than about 350 mmHg. Thus, first lumen 30 usually has a transverse cross-sectional area of about 2.0-3.0 mm², and preferably about 2.4-2.8mm² between first port 32 and first opening 34.

Please amend Page 14, line 25 through Page 15, line 11, as follows:

In an additional aspect of the invention, illustrated in Figure 3B, a pulmonary artery catheter 69 and a coronary sinus catheter 71 are utilized in conjunction with cardioplegia catheter 20. These catheters may be introduced transluminally into the heart from a peripheral vein such as internal jugular vein IV. Pulmonary artery catheter 69 is advanced from right atrium RA through the tricuspid valve TV, right ventricle RV and pulmonary valve PV into the pulmonary artery P A. The catheter is connected at its proximal end to a pump or other fluid aspiration device. Any blood or fluids not removed by venous cannula 51 that reach the pulmonary artery may be removed through pulmonary artery catheter PV, thereby keeping the heart adequately vented. Blood removed through pulmonary artery catheter 69 may be returned to blood filter/recovery module 65 for treatment and return to the body via cardiopulmonary bypass system 55. Other aspects of pulmonary artery catheters suitable for use in conjunction with the present invention are described in copending application No. 08/415,238, filed March 30, 1995, now abandoned, which is incorporated herein by reference.

Serial No. 09/617,459

Please amend Page 16, line 1 through line 16 as follows:

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A preferred technique of positioning cardioplegia catheter 20 in the ascending aorta is shown in Figures 4-6. In this technique, a purse-string suture 60 is placed in the left atrial wall W around the intended site of catheter introduction, as shown in Figure 4. Suture 60 may be placed using well-known techniques, and is preferably placed using thoracoscopic instruments introduced through small incisions, trocar sleeves or other intercostal access ports not requiring a gross thoracotomy. The left atrium may be accessed via access ports in the 3rd, 4th or 5th intercostal spaces on the right lateral or right anterior side of the chest. If desired, the heart may be repositioned within the chest to improve access using thoracoscopic retraction instruments introduced through access ports between the ribs. Once purse-string suture 60 has been placed in wall W, a small incision or puncture P is formed in wall W so as to be encircled by suture 60, and a flow-directed catheter 64, shown in Figure 5, is inserted through puncture P. The free ends 62 of suture 60 may then be tensioned so as to form a seal between wall W and the outer wall of flow-directed catheter 64. Preferably, a suture tensioner 66 is used to maintain tension on suture ends 62, which may consist of a tube 62a having an inner lumen 70 through which ends 62 may be passed. Lumen 70 is dimensioned frictionally engage suture ends 62 so as to maintain adequate tension on suture S to create a hemostatic seal around catheter 64.

Please amend Page 17, line 20 through Page 18, line 3, as follows:

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As may be seen in Figure 3A shaft 22 of cardioplegia catheter 20 must be shapable into a curve of very small radius in order to extend through both the aortic valve A V and mitral valve MV, a distal portion of the shaft which extends through the aortic valve being at an angle of around 100-170 degrees, preferably about 110 to 150 degrees, relative to the proximal portion of the shaft which extends through the mitral valve. Preferably, shaft 22 will be reinforced in at least the region of this curve with a wire winding (not shown) embedded in its outer wall to prevent the shaft from kinking. Suitable wire-wound shafts and methods of manufacturing such shafts are described in copending application Serial No. 08/664,716, filed

Serial No. 09/617,459

June 17, 1996, , now issued as U.S. Patent No. 5,879,499, which is incorporated herein by reference.

Please amend Page 19, line 18 through Page 20, line 3, as follows:

Unlike the previous embodiment, cardioplegia catheter 80 further includes a ventricular balloon 110 spaced proximally from occlusion member 84 and first and second openings 90,94. The position of ventricular balloon 110 on shaft 82 is selected such that it will be disposed in the left ventricle adjacent the aortic valve when occlusion balloon 84 is in the ascending aorta between the brachiocephalic artery and the coronary arteries, usually being positioned about 4-8 cm proximally of occlusion balloon 84 for use in adult patients. Ventricular balloon 110 is inflated via a second inflation lumen 112 extending from a second 25 inflation port 114 at the proximal end of the shaft to a second inflation opening 116 in shaft 82 within the ventricular balloon. The balloon will preferably be inflatable to a diameter of about 2-4 cm to facilitate occlusion of the ventricular outflow tract at the around the annulus of the aortic valve.

In the Claims:

✓ Please cancel claims 8 and 9, without prejudice, and amend claims 1, 4, 19 and 20 as follows:

1. A cardioplegia catheter for inducing cardioplegic arrest comprising:

a shaft with a distal end, a proximal end, an opening near the distal end, a port at the proximal end, and an inner lumen fluidly connecting the port and the opening, a distal portion of the shaft being configured to extend into the ascending aorta when a proximal portion of the shaft extends into a left chamber of the heart through the aortic valve and out of the heart through a penetration in a wall thereof; and

an occlusion member mounted to the shaft distally of the opening and configured to occlude the ascending aorta between the brachiocephalic artery and the coronary ostia.